Table A1 (continued). CAPITAL EXPENDITURES FOR MUNICIPAL SEWAGE COLLECTION AND TREATMENT

| Year | System | Type of project[a] | Costs, dollars: Treatment plant[b] | Costs, dollars: Interceptor, out fall, or lift station[b] | Costs, dollars: Engineering[c] |
|---|---|---|---|---|---|
| 1968 | Albany | STP add | 2,103,000 | | 130,000 |
| | Amity | Lagoon | 48,423 | | 5,900 |
| | Dallas | Int. Ext | | 338,412 | 28,000 |
| | Oakridge | STP add, Int. Ext | 294,342 | | 25,000 |
| | Portland | Int, Int. Ext | | 2,632,171 | 160,000 |
| | Propco | STP | 12,000[d] | | 1,800 |
| | River Village T.P. | STP | 5,000[d] | | 700 |
| | Skyline West | Lagoon | 10,000[d] | | 1,500 |
| | | | 2,500,000 | 2,970,583 | 350,000 |
| 1969 | A. P. Industrial Park | STP | 6,500[d] | | 1,000 |
| | American Can Co. | STP | 11,500[d] | | 1,700 |
| | Halsey | Lagoon | 104,615 | | 11,000 |
| | Hillsboro | STP-new | 1,433,721 | | 99,000 |
| | Inverness | STP | 400,000 | | 32,000 |
| | Jefferson | Lagoon | 139,183 | | 14,000 |
| | Mountain States Investment | STP | 16,000[d] | | 2,400 |
| | Portland | STP add | 2,664,364 | | 160,000 |
| | Stuckey's Pecan | Lagoon | 3,000[d] | | 400 |
| | Tigard | Int. Ext. | | 61,587 | 7,100 |
| | Timberlakes Job Corps | LS, Sewers | | 46,000 | 5,000[f] |
| | West Salem | STP, Int | 729,105 | | 51,000 |
| | Dallas | New STP | 1,000,000 | | 68,000 |
| | | | 6,500,000 | 107,587 | 450,000 |

Table A1 (continued). CAPITAL EXPENDITURES FOR MUNICIPAL SEWAGE COLLECTION AND TREATMENT

| | | | Costs, dollars | | |
|---|---|---|---|---|---|
| Year | System | Type of project[a] | Treatment plant[b] | Interceptor, out fall, or lift station[b] | Engineering[c] |
| 1970 | Aumsville | Lagoon | 169,829 | | 16,000 |
| | Dundee | Lagoon | 266,427 | | 23,000 |
| | Eugene | STP add | 1,156,795 | | 44,000[f] |
| | Gresham | Int. Ext. | | 769,106 | 54,000 |
| | Lake Oswego | Int. Ext. | | 170,724 | 16,000 |
| | Lebanon | Int. Ext. | | 208,141 | 19,000 |
| | McMinnville | STP add, Int, Ext | 1,250,000 | 122,700 | 89,000 |
| | Newberg | STP add | 761,038 | | 53,000 |
| | Oak Lodge S.D. | STP add | 27,864 | | 6,613[f] |
| | Portland | Int. Ext. | | 589,349 | 43,000 |
| | Portland | Int. Ext. | | 382,576 | 30,000 |
| | River Bend Mobile Park | STP | 49,000[d] | | 6,000 |
| | Silverton | STP add | [g] | | |
| | Tualatin | STP | 315,000[d] | | 26,000 |
| | Veneta | Lagoon | 231,937 | | 20,000 |
| | West Linn | Int. Ext. | | 338,546 | 27,000 |
| | Washington Co. | Beaverton Int.Ext | | 114,700 | 11,000 |
| | | | 4,200,000 | 2,695,842 | 480,000 |
| 1971 | Albany | Int. Ext. | | 1,621,850 | 100,000 |
| | Clackamas Co. (Tri-City) | New STP, Int. Ext | 1,067,700 | | 71,000 |
| | Columbia Way Crt. | STP | 18,000[d] | | 2,800 |
| | Fir Cove | Lagoon | 11,000[d] | | 1,600 |
| | Hillsboro | Int. Ext. | | 997,845 | 67,000 |
| | Oak Lodge S.D. | STP add | 318,209 | | 44,997[f] |
| | Philomath | STP add | 210,348 | | 19,000 |
| | Riverview Mobile Ranch | STP | 52,000[d] | | 6,100 |
| | St. Helens | STP add | 2,642,806 | | 160,000 |
| | Sauvie Island Moorage | STP | 8,000[d] | | 1,200 |
| | Scappoose | STP, Int., Out | 686,700 | | 49,000 |
| | | | 5,000,000 | 2,619,695 | 520,000 |

Table A1 (continued). CAPITAL EXPENDITURES FOR MUNICIPAL SEWAGE COLLECTION AND TREATMENT

| | | | Costs, dollars | | |
|---|---|---|---|---|---|
| Year | System | Type of project[a] | Treatment plant[b] | Interceptor, out fall, or lift station[b] | Engineering[c] |
| 1972 | Canby | STP add, Int. Ext | 302,756 | | 25,000 |
| | Century Meadows | STP | 53,000[d] | | 6,300 |
| | Cottage Grove | Int. Ext. | | 77,144 | 8,300 |
| | Fanno Creek | Int. Ext. | | 2,035,400 | 130,000 |
| | Lake Oswego | Int. Ext. | | 102,670 | 10,000 |
| | Sandy | STP | 416,000 | | 37,000[f] |
| | Timberlakes Job Corps | Lab | 12,000 | | 2,000[f] |
| | Wilsonville | STP, Int. Out | 773,000 | | 54,000 |
| | | | 1,600,000 | 2,215,214 | 270,000 |
| 1973 | Dikeside Moorage | STP | 8,000[d] | | 1,200 |
| | Gresham | STP, Out | 2,831,414 | | 170,000 |
| | Marylhurst | STP impr | 1,032 | | |
| | Multnomah Co. | Int. Ext. | | 1,908,125 | 120,000 |
| | Oak Lodge S.D. | STP add | 883,371 | | 91,886[f] |
| | Portland | Int. Ext. | | 2,231,510 | 140,000 |
| | Stayton | STP add | 453,200 | | 35,000 |
| | Willow Island Mobile Estates | STP | 45,000[d] | | 5,500 |
| | Woodburn | Lagoon | [g] | | |
| | | | 4,200,000 | 4,139,635 | 560,000 |

Table A1 (continued). CAPITAL EXPENDITURES FOR MUNICIPAL SEWAGE COLLECTION AND TREATMENT

| | | | Costs, dollars | | |
|---|---|---|---|---|---|
| Year | System | Type of project[a] | Treatment plant[b] | Interceptor, out fall, or lift station[b] | Engineering[c] |
| 1974 | Central Linn H.S. | Halsey hookup | | 39,000 | 5,000 |
| | Hillsboro | STP add | 1,285,000 | | 120,000 |
| | Kellog (Clackamas) | Int, STP | 8,647,101 | | 480,000 |
| | Lafayette | STP add | 165,000 | | 15,000 |
| | McMinnville | Int. Ext. | | 243,000 | 21,000 |
| | Milwaukie | Int. Ext. | | 900,100 | 61,000 |
| | Oregon Primate Research Center | STP impr | 82,422 | | 10,155 [f] |
| | Portland | STP add | 21,398,600 | | 1,100,000 |
| | Portland | STP impr | 1,679,000 | | 100,000 |
| | Sweet Home | STP add | 1,152,000 | | 75,000 |
| | Timberlakes Job Corps | STP add | | | 25,000 [f] |
| | Washington Co. | | | | |
| | Cedar Mill | Int. Ext. | | 569,000 | 42,000 |
| | Durham | STP | 24,700,000 | | 1,300,000 |
| | Fanno Creek | Int. Ext. | | 1,961,000 | 120,000 |
| | Forest Grove - Cornelius | Int. Ext. | | 305,000 | 25,000 |
| | Forest Grove | STP add | 2,798,000 | | 170,000 |
| | Sherwood | STP impr | 550,000 | | 40,000 |
| | Wood Village | Int. Ext. | | 231,990 | 20,000 |
| | | | 62,000,000 | 4,249,090 | 3,700,000 |

[a] Abbreviations: add. - addition; equip. - equipment; exp. - expansion; ext. - extension; impr. - improvement; Int. - Interceptor; LS - lift station; Out. - outfall; STP - sewage treatment plant.

[b] Figures from state and federal reports or OSU WRRI survey results except as noted by d.

[c] Estimated except as noted by f.

[d] Estimated.

[e] Treatment works no longer operating. Excludes plants which have been replaced at site. Includes only those which have abandoned in favor of a regional plant.

[f] Reported by owner.

[g] Figure not available.

# APPENDIX B

## MUNICIPAL TREATMENT PLANT DATA

See table B1.

Table B1. 1973-74 OPERATION AND MAINTENANCE DATA: MUNICIPAL SEWAGE TREATMENT PLANTS[a]

| Type of plant[b] | Average flow, mgd | Influent BOD/SS, mg/l | Effluent BOD/SS, mg/l | Staffing, $/mg | Chlorine | | | Electricity | | Maintenance, $/mg | Total O&M, $/mg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Residual, mg/l | Applied, lb/mg | Cost, $/mg | Used, kwh/mg | Cost, $/mg | | |
| P | 92.0 | 162/118 | 138/51 | 11.60 | 0.5 | | | | 0.51 | | 30.50 |
| P | 2.2 | 81/ | | 40.20 | | 39.4 | 2.68 | 82.5 | 1.90 | | 61.88 |
| AL | 29.4 | | 49/76 | | | | | 628.0 | 6.28 | | 23.18 |
| TF | 23.7 | 212/152 | 36/39 | 21.72 | 1.0 | 55.8 | 2.73 | | 2.95 | | 58.34 |
| TF | 18.67 | 288/202 | 32/32 | 24.10 | 1.5 | 52.5 | 2.76 | 227.0 | 3.41 | 7.87 | 41.10 |
| AS | 6.80 | 174/169 | 19/16 | 77.50 | 0.7 | 38.7 | 1.97 | 1070.0 | 10.40 | 9.10 | 114.00 |
| TF | 7.14 | 151/142 | 47/45 | 30.74 | 1.0 | 44.9 | 2.51 | | 5.88 | 4.06 | 49.38 |
| TF | 8.7 | 103/134 | 28/24 | 17.35 | | 23.6 | 1.42 | | | | 23.56 |
| AS | 5.07 | 133/ | 7/11 | | 1.5 | 25.8 | | | | | 164.00 |
| AS | 3.95 | 150/315 | 17/30 | | 2.7 | 49.4 | 2.72 | 1204.0 | 13.24 | | |
| AS | 2.71 | 191/470 | 21/9 | 104.00 | 1.9 | 72.7 | 4.45 | 2211.0 | 24.77 | 5.67 | 193.00 |
| AS | 1.9 | 250/250 | 22/22 | 148.00 | 1.0 | 60.9 | | | | | 188.00 |
| AS | 3.64 | 181/221 | 12/18 | 48.53 | 2.5 | 33.8 | 2.13 | 717.0 | 8.32 | 14.68 | 93.40 |
| AS | 1.48 | | 15/14 | 182.00 | 2.0 | 77.0 | 6.85 | | | 4.72 | 277.00 |
| TF-EF | 2.0 | 231/ | 21/22 | | 1.5 | 74.7 | 5.98 | | | | |
| AS | 5.95 | 149/119 | 27/24 | 63.97 | 1.5 | 33.3 | 2.00 | | 8.07 | 3.18 | 88.16 |
| AS | 2.63 | 231/ | 25/ | | 1.4 | 49.8 | 2.36 | 1364.0 | 15.01 | | |
| TF-L | 2.87 | 410/221 | 9/67 | | | 73.2 | 3.43 | 510.0 | 4.39 | | |
| AS | 4.08 | 117/137 | 13/8 | 47.20 | | | | | | 1.34 | 69.57 |
| AS | 1.63 | 132/ | 59/44 | | 1.8 | 60.1 | 2.83 | 1352.0 | 16.90 | | |
| TF | 3.0 | 100/ | 27/ | 18.22 | 1.0 | 30.1 | 2.29 | | 6.10 | 2.05 | 31.74 |
| TF-AS | 1.54 | 183/ | 24/28 | | 2.3 | 79.2 | 3.76 | | 15.61 | | |
| AS | 2.15 | 115/115 | 30/30 | 148.00 | 3.0 | 60.9 | | | | | 188.00 |
| TF | 1.7 | 203/ | 21/ | | | 32.4 | | | | | |
| TF-L | .64 | 182/162 | 17/17 | 137.00 | 2.0 | 59.9 | 8.56 | | 10.70 | 23.11 | 230.00 |
| TF | 1.87 | 114/78 | 25/21 | | 2.2 | 40.2 | | | | | |
| AS | 1.28 | 223/104 | 18/31 | | | 59.1 | | | | | |
| AL-EF | 4.01 | 140/198 | 19/21 | | 1.5 | 62.3 | 2.84 | 1760.0 | 16.20 | | |
| EA | .25 | | | | | 80.0 | | | | | |
| EA | .329 | 217/ | 40/ | | | 37.8 | | | | | |
| AS | .40 | 173/170 | 16/16 | 220.00 | 1.8 | 86.3 | | | 17.12 | | |
| AS | 2.0 | 80/100 | 8/8 | 12.61 | 0.8 | 29.5 | | 1120.0 | 13.26 | 1.24 | 40.66 |

Table B1 (continued). 1973-74 OPERATION AND MAINTENANCE DATA: MUNICIPAL SEWAGE TREATMENT PLANTS

| Type of plant [b] | Average flow, mgd | Influent BOD/SS, mg/l | Effluent BOD/SS, mg/l | Staffing, $/mg | Chlorine Residual, mg/l | Chlorine Applied, lb/mg | Chlorine Cost, $/mg | Electricity Used, kwh/mg | Electricity Cost, $/mg | Maintenance, $/mg | Total O&M, $/mg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TF | .64 | | | | | 31.0 | | | | | |
| TF | .323 | | | | 2.0 | 54.2 | 9.21 | 77.2 | 1.90 | 41.76 | 67.45 |
| TF | .36 | 101/152 | 9/27 | | 3.4 | 58.3 | 2.77 | 968.0 | 16.00 | | |
| EA | .5 | 150/145 | 10/11 | 681.00 | 1.4 | 131.6 | 7.67 | | | 32.88 | |
| TF | .211 | | | | 1.9 | 76.9 | | | | | |
| AS | .44 | 152/ | 18/ | | | 29.2 | 4.09 | | | | |
| EA | .153 | 247/208 | 9/8 | 205.00 | 1.6 | | 9.90 | | 118.00 | 8.60 | 314.00 |
| EA | .85 | 50/48 | 6/15 | | 2.7 | | | | | | |
| TF | .12 | | | | | 40.0 | | | | | |
| TF | .10 | | | 24.65 | 3.0 | | | 583.0 | 12.67 | 4.79 | 43.76 |
| AS | .2 | 200/175 | 10/10 | 266.00 | 1.5 | 54.8 | 11.37 | 1973.0 | 31.17 | 2.74 | 338.00 |
| TF | .61 | | | | | 25.0 | 4.50 | 838.0 | 15.90 | | |
| AL | .19 | | | | | 32.0 | 4.16 | | 8.90 | | |
| L | .149 | 150/150 | | 63.00 | | 53.8 | | | 9.20 | 57.00 | 129.00 |
| L | .074 | | 10/12 | 355.00 | | | | | 6.77 | 91.32 | 463.00 |
| TF | .112 | | | 186.00 | 2.0 | 88.0 | 13.16 | 1325.0 | 23.26 | 31.84 | 361.00 |
| EA-EF | .257 | 362/397 | 8/10 | | | 79.0 | | | | | |
| TF | .005 | | | | | 620.0 | | | | | |
| L | .034 | | | 591.00 | | 48.2 | 7.40 | | 47.89 | 24.17 | 937.00 |
| EA | .069 | | | | 2.7 | 71.7 | | | | | |
| EA | .107 | | | | 2.3 | 45.5 | 2.09 | | 73.37 | | |
| EA | .008 | | | | | | 38.00 | | 230.00 | | |
| EA-L | .045 | | 20/20 | 207.00 | 2.0 | 219.0 | 48.71 | 5666.0 | 62.37 | 91.32 | 412.00 |
| EA-L | .059 | 350/450 | 38/55 | 952.00 | 2.5 | 130.0 | 16.90 | | | 1.63 | 1,300.00 |
| EA | .06 | | | | | 90.0 | | | | | |
| EA-L | .015 | | | 230.00 | | 390.0 | 152.00 | | 71.00 | | |
| EA | .0148 | | | | | | 140.00 | | 680.00 | | |
| EA-L | .03 | | | 438.00 | | | 14.90 | | 219.00 | 146.00 | 819.00 |
| L | .079 | | 56/ | | 1.5 | | 13.90 | | 34.68 | 128.00 | 830.00 |
| TF | .057 | 196/161 | 21/30 | | | 78.8 | | | | | |
| EA | .066 | | | | | 106.0 | | | | | |
| EA-L | .073 | 107/73 | 10/14 | | | | | | | | |
| EA | .22 | | | | | 160.0 | | | | | |

a Information from OSU WRRI questionnaire and survey of monthly reports submitted to the Department of Environmental Quality.

b Type: AL - Aerated Lagoon; AS - Activated Sludge; EA - Extended Aeration; EF - Effluent Filtration; L - Lagoon P - Primary; TF - Trickling Filter

## APPENDIX C

## WATER TREATMENT PLANT LOCATION

To date only one city - Corvallis - has constructed a water treatment facility that uses the Willamette River as a source. The other river communities generally employ tributaries as supplies while a few have ground water sources. In many instances where the engineering knowledge existed to purify Willamette River water for drinking and where the economics favored using the river, political and public pressure was applied to opt for alternative sources. This was done for aesthetic reasons and fear of using water which carried wastes from upstream.

A survey of the chemical application records at the H. D. Taylor Water Treatment plant in Corvallis for the period 1955-1973 revealed that economies have been realized in recent years. Whether or not these savings are even partially the result of improved river quality is open to speculation. Figure C1 presents a history of chemical use for the nineteen year period. Note particularly the drop in chlorine, the plant disinfectant, and carbon, used for taste and odor control. There has been a definite drop in coliform organisms in the river during the past decade, which could possibly explain the reduction in chlorine use. Little historical data regarding taste and odor problems exist but the reduction in carbon use roughly corresponds to the installation of secondary treatment at an upstream pulp mill.

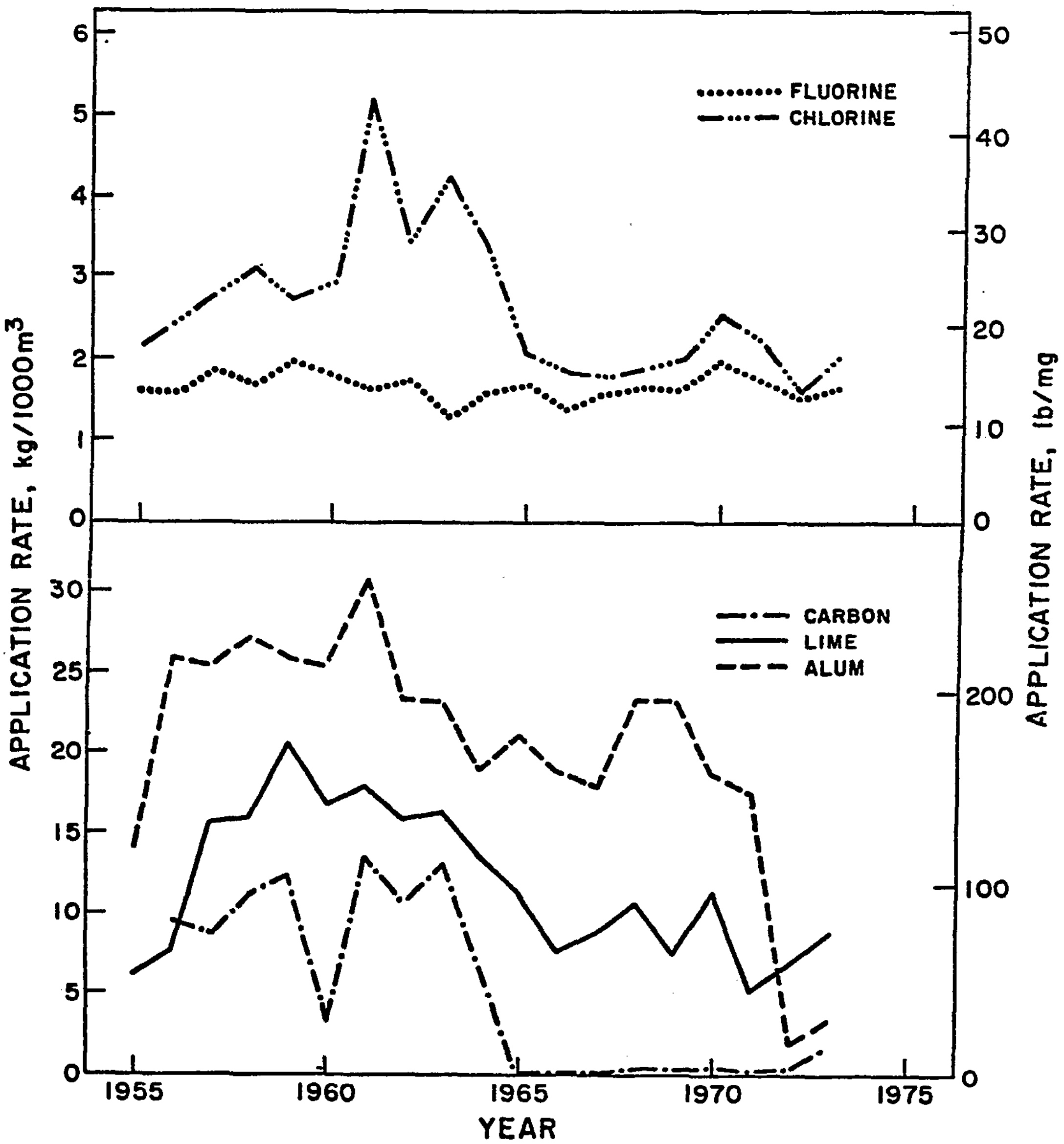


Figure C1. Chemical application history at the H. D. Taylor Water Treatment Plant, Corvallis.

## TECHNICAL REPORT DATA

*(Please read Instructions on the reverse before completing)*

| )RT NO. | 2. | 3. RECIPIENT'S ACCESSION NO. |
|---|---|---|
| -600/5-76-005 | | |

| | |
|---|---|
| E AND SUBTITLE<br>TORING THE WILLAMETTE RIVER: COSTS AND IMPACTS OF<br>ER QUALITY CONTROL | 5. REPORT DATE<br>September 1976 (Issuing Date)<br>6. PERFORMING ORGANIZATION CODE |
| HOR(S)<br>Scott Huff, Peter C. Klingeman, Herbert H. Stoevener,<br>Howard F. Horton | 8. PERFORMING ORGANIZATION REPORT NO |
| ORMING ORGANIZATION NAME AND ADDRESS<br>er Resources Research Institute<br>gon State University<br>vallis, OR 97331 | 10. PROGRAM ELEMENT NO.<br>1BA030<br>11. CONTRACT/GRANT NO.<br>68-01-2671 |
| NSORING AGENCY NAME AND ADDRESS<br>ironmental Research Laboratory<br>'ice of Research and Development<br>. Environmental Protection Agency<br>ens, Georgia 30601 | 13. TYPE OF REPORT AND PERIOD COVERED<br>Final Report<br>14. SPONSORING AGENCY CODE<br>EPA-ORD |

PLEMENTARY NOTES

TRACT


The means by which the water quality of the Willamette River has been upgraded over the past four ecades are documented. Two strategies--point-source wastewater treatment and flow augmentation from network of federal reservoirs--have been responsible for this improvement in water quality. The eries of tactics employed in gradually reducing point-source waste discharges are documented. Coinci-ent water quality benefits which have resulted from flow augmentation for other purposes are also dis-ussed. The economic and energetic costs of constructing, operating, and maintaining the facilities hich have significantly contributed to the improvement of water quality in the Willamette River and ts tributaries over the last half century are examined. Data are presented regarding the construction nd operation of municipal collection and treatment systems, industrial water pollution abatement acilities, and reservoirs. Input-Output economics and a methodology for converting dollar costs to irect and total energy requirements are used to deal with construction and operational costs. Opera-ion and maintenance expenditures are also dealt with on the basis of direct at-site requirements. nergy needs for operating water quality control facilities are about one-tenth of one percent of total asin energy utilization. Substantial savings of this energy are possible however. Historic and urrent status of the fishery and wildlife resources of the Willamette River Basin are reviewed in re-ation to changing water quality of the River. Recent improvements in water quality have stimulated tate and Federal agencies to embark on a nine-year program to fully develop the fishery resources of he Basin. The potential biologic, economic, and social values of the program are presented along ith related adverse effects attributed to water quality improvement procedures.


KEY WORDS AND DOCUMENT ANALYSIS

| DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| ergy<br>onomics<br>ste water<br>ter treatment<br>servoirs<br>shes<br>ldlife | Wastewater treatment plants<br>Flow augmentation<br>Environmental effects<br>Energy analysis<br>Water quality control<br>Willamette River (Oregon) | 2B<br>13B |

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